

Mass stranding of pleustonic cnidarians on Gujarat coastline, India

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ABSTRACT

Present communication reports mass beach stranding of *Physalia physalis*; *Porpita porpita* and *Velella velella* from the various coasts of Gujarat coastline of India during monsoon season (July - August), 2022. *Physalia physalis* was the most coasted cnidarian on studied coastline and also responsible for toxic stung. Increasing mass stranding events indicates need of proper monitoring or predicting system based on wind and current patterns as these pleustonic cnidarians coasted by wind and oceanic currents.

Keywords: Mass beach stranding, *Physalia physalis*; *Porpita porpita* and *Velella velella*, Gujarat coast.

1. INTRODUCTION

The pleustonic cnidarian *Velella velella*, *Porpita porpita*, and *Physalia physalis* are all considered colonial and are mostly affected by winds due to its morphological adaptations (i.e., the sails) extending above the water's surface. The oceanic current is the primary mechanism that determines an individual's path and cause mass stranding on beach. Amongst all these three, Portuguese man-of-war, *Physalia physalis* (Linnaeus, 1758), commonly found in the tropical and subtropical areas of the world's oceans. It is siphonophore species with a large gas float and lives at the ocean surface, where its distribution is affected mainly by winds. This was the first siphonophore to be formally described and introduced, as long ago as 1758, by Carl Linnaeus (Mapstone 2015). It is commonly called as the Portuguese man-of-war, Portuguese galley, Blue bottle, or Sea bladder. It has stinging cells (cnidocytes) with toxins that are powerful enough to harm humans seriously (Burnett et al., 1994; Cegolon et al., 2013; Haddad Jr. et al., 2013; Mapstone, 2015), although they rarely cause death (Prieto et al., 2015). Local reactions produced by such cnidarian's envenomation include painful, linear, red, hive-like lesions. Pain is perceived instantly, is maximal within 5 min and dissipates over the next few hours (Burnett 2001). In some patients, the cutaneous eruptions may be dramatically swollen, may be delayed for several hours, may persist up to several months or be recurrent without further stings (Mansson et al., 1985; Maretic, 1986; Burnett & Calton, 1987). The pathogenesis of cnidarian stings, its envenomation and therapy are well discussed by Burnett (2001), like syndromes resulting from *Physalia physalis* envenomation includes Immediate

cardiac arrest, delayed renal failure, Respiratory acidosis, Distant site reactions, Local lymphadenopathy, Contractions, Arthritis, Vascular spasm, Mononeuritis, Acquired cold urticaria, Granuloma annular, Urticaria.

The stranding patterns of the pleustonic species *Veleva veleva*, *Porpita porpita*, and *Physalia physalis* have been poorly analyzed in Indian coastline as they are not species of fisheries importance and their direct ecological role is least understood. Mass beach stranding of *Porpita porpita* along the Odisha coast was reported during summer season (Sahu et al. 2020). Stranding of *P. porpita* was earlier reported from Gujarat at Adri coast by CMFRI (2010); Veraval coast by Poriya (2015) and recent mass stranding from the Mandvi coast by Shah and Shah (2021). The stranding pattern of *P. physalis* along the Gujarat coast comprised few sightings during the regular studies of intertidal macrofauna in past years. Poriya (2015) reported stranding during winter season at Veraval coast. In August, 2018, news entitled “Venomous blue bottle jellyfish injured over 150 people at Mumbai beaches, result of global warming?” reflected in India Today (shorturl.at/jlP49). As local remedy, lemon was rubbed at stung area by localities. Jellyfish swarms invade at the famous Goa beach during November, 2020 and 90 people were stung by *Physalia* (shorturl.at/mn013). Such events need a scientific attention and by concerning this phenomenon, we have tried to document this on various coasts of Gujarat coastline.

2. METHOD

Direct sighting of *P. physalis*; *Porpita porpita* and *Veleva veleva* was noted during regular field surveys on various coastal areas of Gujarat like Mandvi, Dwarka, Harsiddhi, Mangrol, Adri, Veraval, Sutrapada, Dhamlej and Kodinar (Figure.1) while sighting news from different sources like media, national and regional news and personal communications were compiled to create strong database. Distribution patterns of stranded colonies on coast was also observed by considering distance from high tide and low tide mark. Visual observation and identification were carried out on field and photographs were taken for documentation. The stranded cnidarians were counted by walking in zigzag patterns along the beach to cover maximum area and to encounter maximum individuals. Local fishermen were interviewed for the stinging events and primary remedies after stung of *P. physalis*.

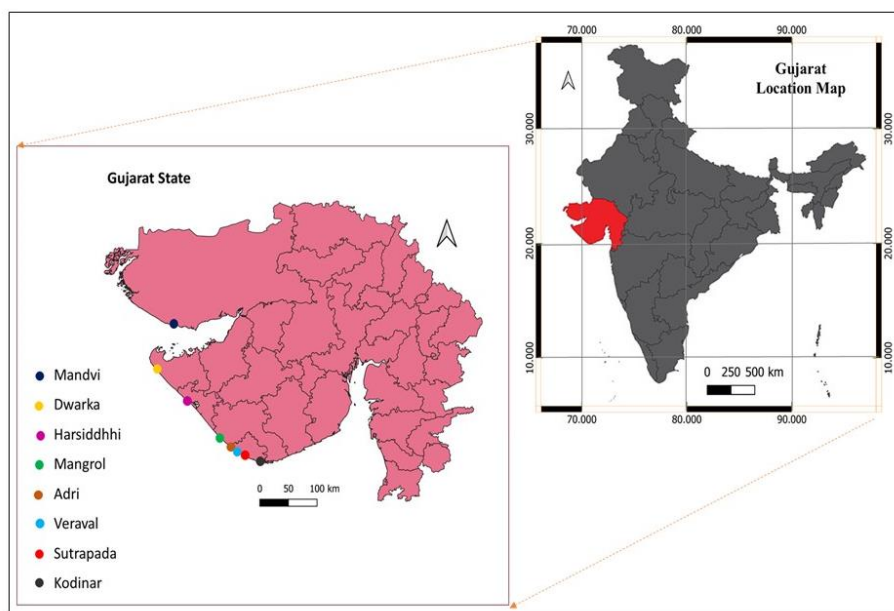


Figure 1: Map of the mass stranding locations of pleustonic cnidarians on Gujarat coast.

3. RESULT & DISCUSSION

Small to large scale of beach stranding of pleustonic cnidarians *Porpita porpita*, *Veleva veleva* and *Physalia physalis* (Figure.2) was observed on various beaches of Gujarat coastline viz, Mandvi, Dwarka, Harsiddhi, Mangrol, Adri, Veraval, Sutrapada, and Kodinar during the monsoon season of 2022. Amongst surveyed locations, Mandvi, Harsiddhi and Mangrol beaches are famous for ecotourism. The tidal amplitude at these various location ranges from 0.1 m to 4.5 m which results in a wide stretch of the intertidal zone. Wind speed noted 11-17 knot. Table-1 shows average number of stranded individuals per 100 meter stretch of coastline. *Physalia physalis* was the most stranded pleustonic cnidarians amongst surveyed locations while very few members of *Porpita porpita* and *Veleva veleva* were observed. In the coastal areas of Gujarat, it is locally known as ‘Popcha’ and ‘Valo’ by localities. Clustered colonies of *Physalia physalis* were common at Veraval, Sutrapada and Kodinar coast. The size of *Porpita porpita* was varied in

stranded form while in case of *Physalia physalis*, majority were similar in size. Distribution pattern or distance from tidal zone indicated that, colonies of *Physalia physalis* were stranded up to spray zone and highest high tide level due to their enlarged pneumatophores (the sail-shaped structure filled with gas) under the direct influence of wind drag, even by moderately strong winds. Colonies of *Porpita porpita* found in upper tidal zone, only few colonies were reported from supratidal or spray zone. All the reported colonies of *Velella velella* were from upper and middle intertidal zones during low tide.

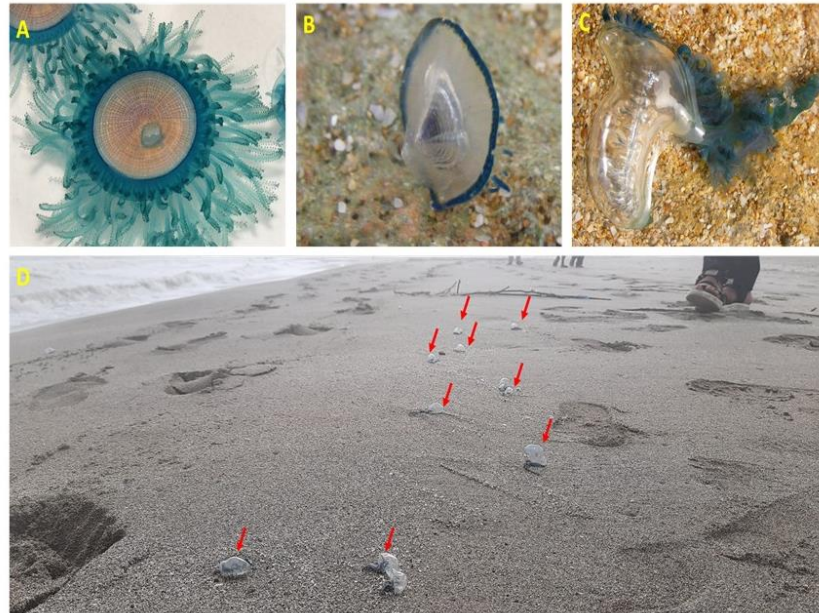


Figure 2: Pleustonic cnidarians. A. *Porpita porpita*, B. *Velella velella*, C. *Physalia physalis*. D. Stranded colonies on coast.



Figure 3: Stranded colonies A-1. *Porpita porpita*, A-2. *Physalia physalis*, B & C. Cluster of *Physalia physalis* is common on few beaches. D. Mass stranding of *Physalia physalis*.

Table 1. Average number of Pleustonic cnidarians stranded per 100 meter stretch of coastline of various coasts of Gujarat.

| | Mandvi | Dwarka | Harsiddhi | Mangrol | Adri | Veraval | Sutrapada | Kodinar |
|--------------------------|--------|--------|-----------|---------|------|---------|-----------|---------|
| <i>Physalia physalis</i> | 142 | 158 | 186 | 176 | 197 | 218 | 209 | 182 |
| <i>Porpita porpita</i> | 8 | 5 | 15 | 17 | 12 | 24 | 18 | 11 |
| <i>Velella velella</i> | -- | -- | 2 | 3 | 2 | 1 | 2 | 1 |

This result suggests that long-term monitoring of stranded event can provide a model for predicting this dangerous species' arrival and warning for beaches and swimmers particularly in the coast with tourism activity and fishermen community. Massive stranding of Portuguese Man-of-War along the southeastern Pacific Ocean is studied with the generalized additive mixed model (GAMM) showed that the oceanographic conditions of warmer temperatures during the winter periods and the weakening of the westerly winds associated with the Niño Southern Oscillation (ENSO) were the most likely causes for the arrival of transport from the colonies to the coast (Canepa et al. 2020). India, generally get affected by two main monsoon currents. Wind and the surface water currents of the north Indian Ocean move towards the northeast during the southwest monsoon, while it reverses the direction towards the southwest during the northeast monsoon in a seasonal pattern. The winds blow strongly during May-September (the southwest monsoon) forming maximum wind stress magnitudes (Shetye et al, 1994). The winds during this season are generally from the southwest, however, they are approximately from the west off the southern part of west coast of India. During November-February (the northeast monsoon), the winds blow from the northeast and have maximum wind stress magnitudes while March-April and October are transition months and winds are weak (Shetye et al, 1994). This wind pattern and direction may primarily responsible for floating of pleustonic cnidarians towards coast as stranding events were chiefly reported during May-September due to location of Gujarat coast.

Affect to Human and Remedies

Amongst the reported pleustonic cnidarians, *Physalia physalis* is known for its painful sting due to the hypotoxin contained in its tentacles, which causes a series of symptoms, from local skin necrosis to neurological and cardiorespiratory problems, and may even cause death (Fathalli et al. 2020). After a sting pain, burning, swelling, and redness immediately felt. Cramps, fever, sweating, weakness, faintness, dizziness, nausea, vomiting, and diarrhea may also occur in stronger reactions. In mentioned coastal area, some of them are well-known tourist beach, an unwelcome scenario of stranding increasing interactions with humans at the coast and with fish can harm local fish stocks, human health and economic losses in the tourism sector. Locally, interviewed fishermen applies hot seawater, self-urine and rubbing of affected area with sands whenever stung by *Physalia physalis*. Few studies (Wilcox et al. 2017) suggest, applying commercially available vinegar solution will cause relief and inactivate the stingers and prevent the release of more toxin, though its controversial (see Fenner et al. 1993 and Cegolon et al. 2013). The Sting No More® Spray was found most effective rinse solutions and irreversibly inhibited cnidae discharge (Wilcox et al 2017). Other remedies like Alcohols, urine, baking soda and shaving cream were found to cause varying amounts of immediate cnidae discharge and failed to inhibit further discharge (Wilcox et al. 2017). Stingose (an aqueous solution of 20% aluminium sulphate and 1.1% surfactant) is also recommended (Cegolon et al. 2013).

4. CONCLUSION

Mass stranding events of cnidarians particularly *Physalia physalis* can cause serious health issues if ignored. Study reports massive stranding in present year compared to previous records based on direct or indirect data sources. Major mass stranding events reported from Gujarat coast were from last five years that indicates need of proper monitoring or predicting system based on wind/current patterns as these pleustonic cnidarians coasted by wind and oceanic currents.

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Authors' contribution

Zalak Sabapara: Data collection, analysis and drafting of manuscript.

Hitisha Baroliya: Data collection and drafting of manuscript

Paresh Poriya: Study conception, analysis and manuscript preparation

Ethical approval

Pleustonic cnidarians on Gujarat coastline, India was observed in the study. The ethical guidelines are followed in the study for species observation & identification.

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Conflicts of interests: The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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